AUV glider observations in the Arctic Ocean

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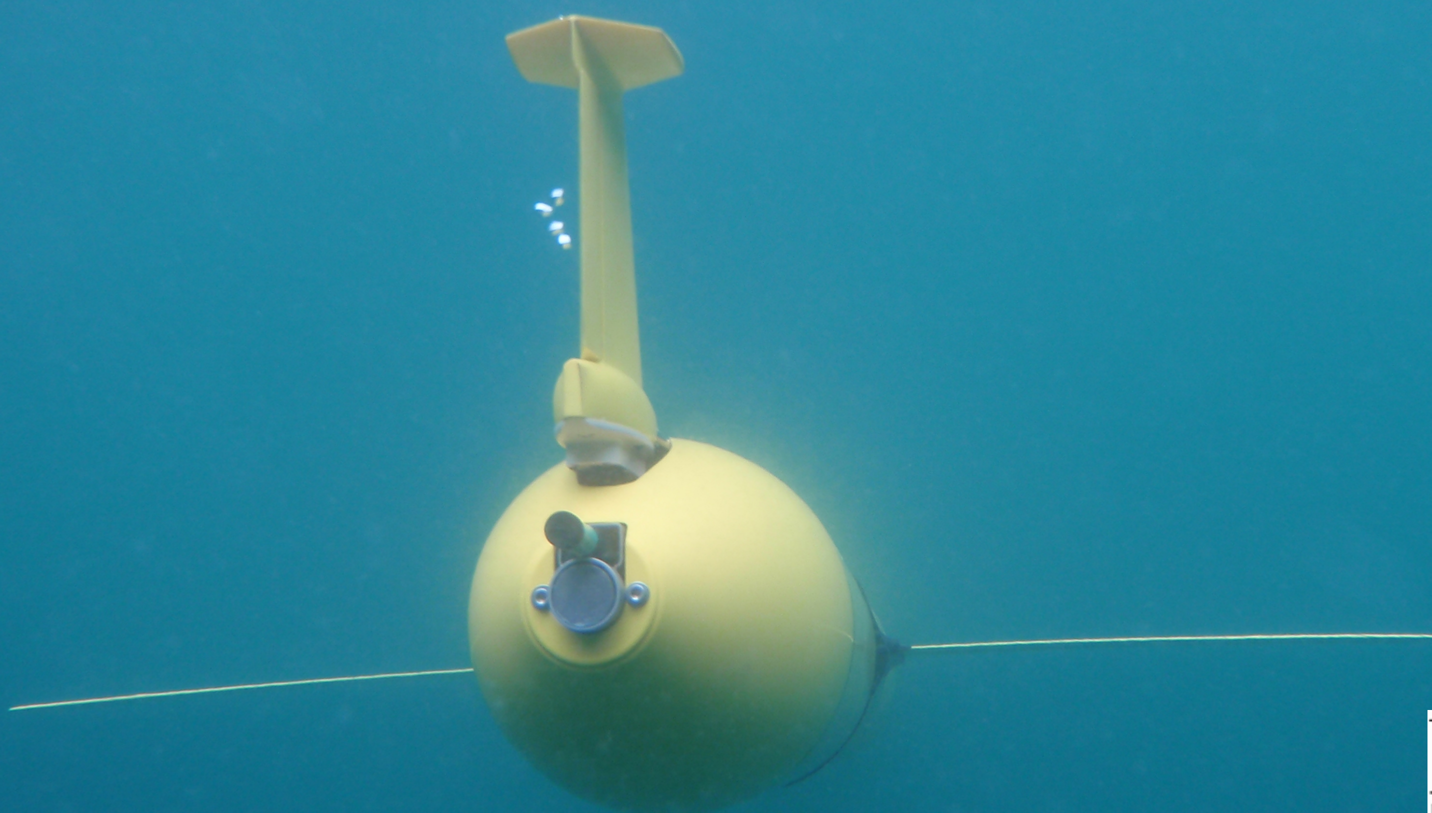
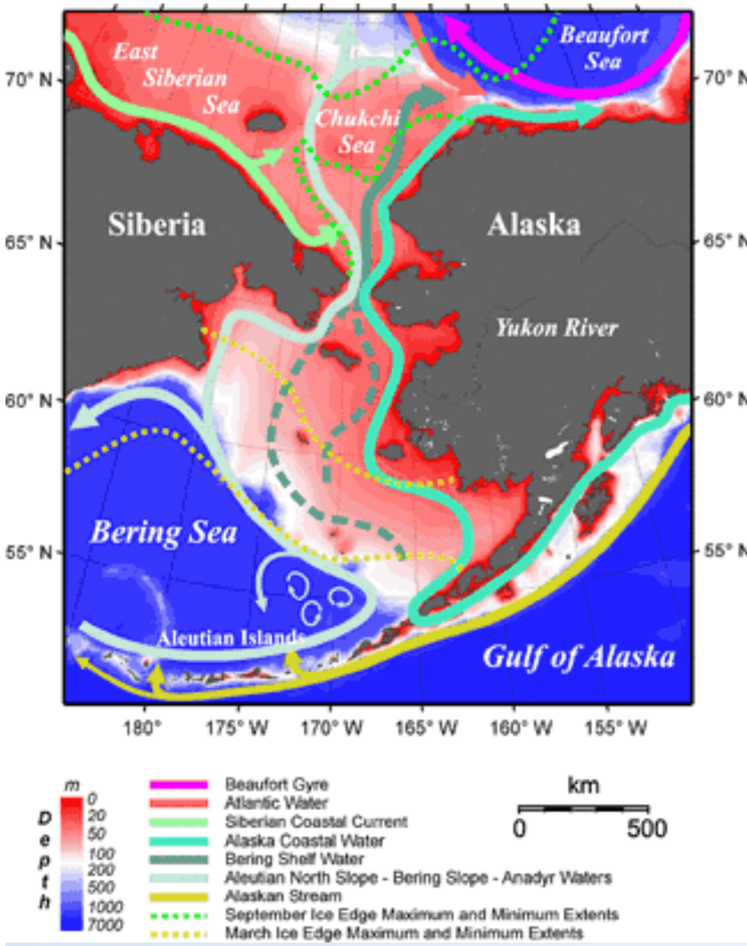
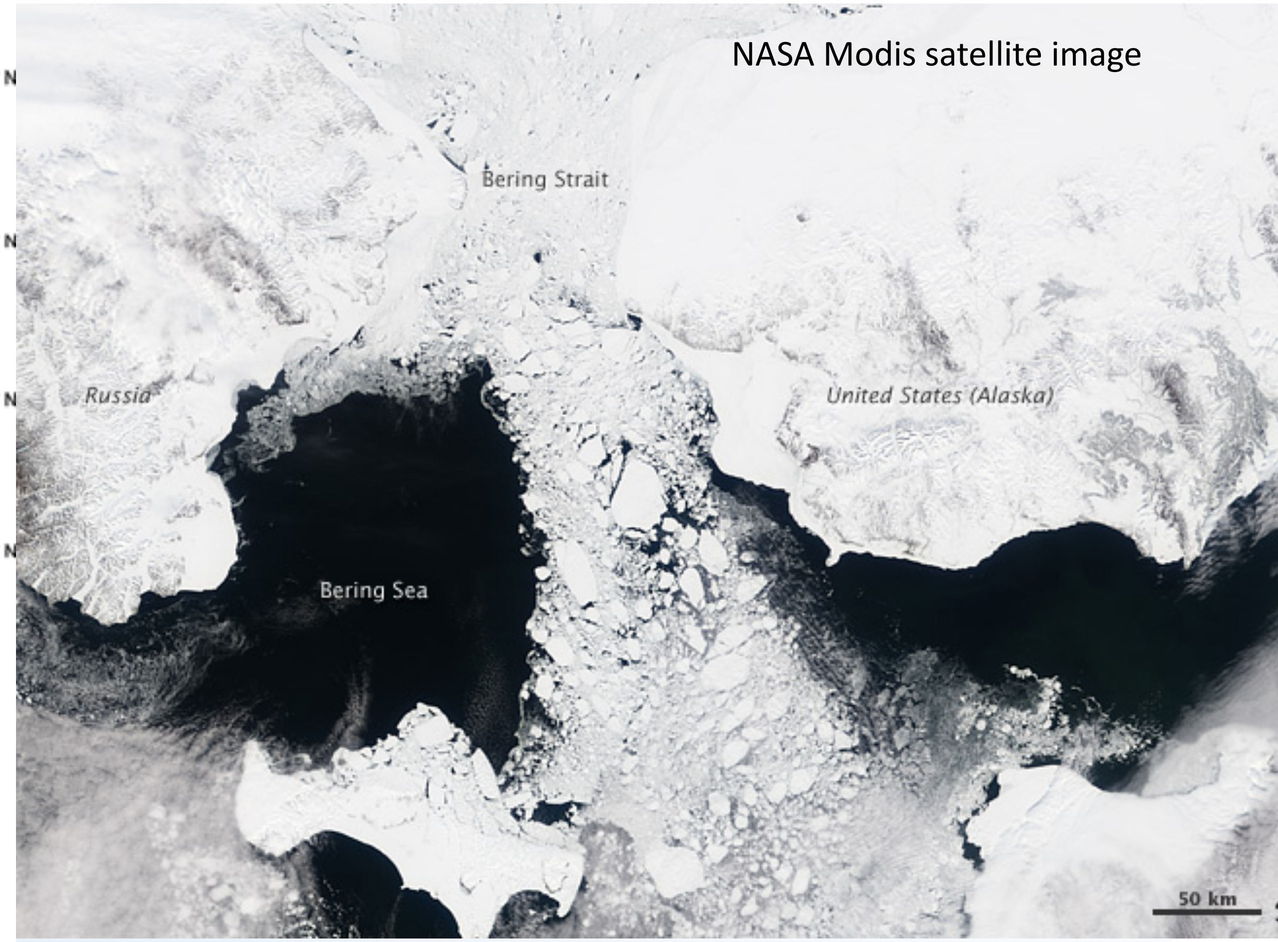


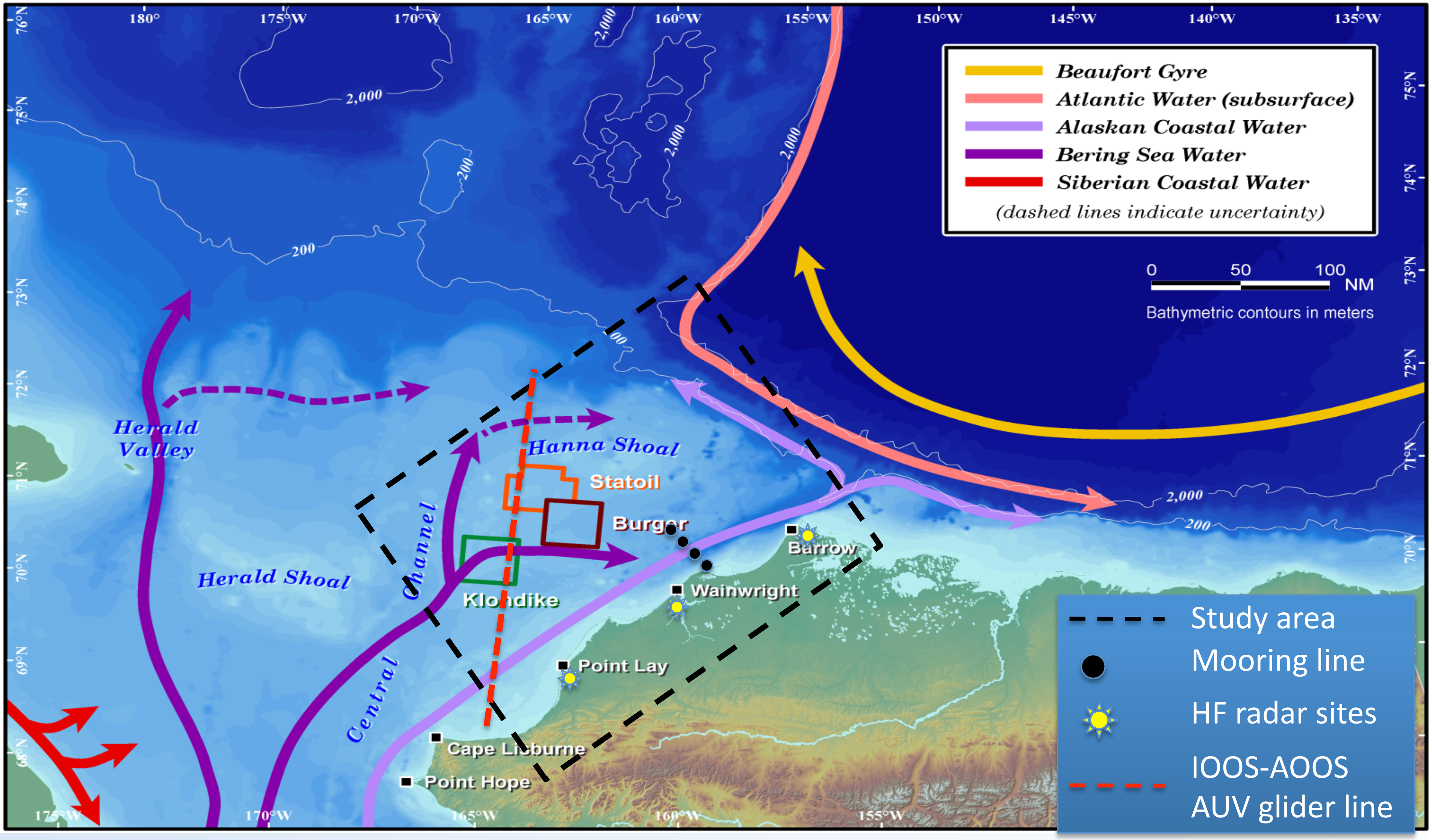




Bering-Chukchi-Beaufort Seas - Direct exchange between the Pacific and Arctic-Atlantic

Seasonally ice covered, high biological productivity

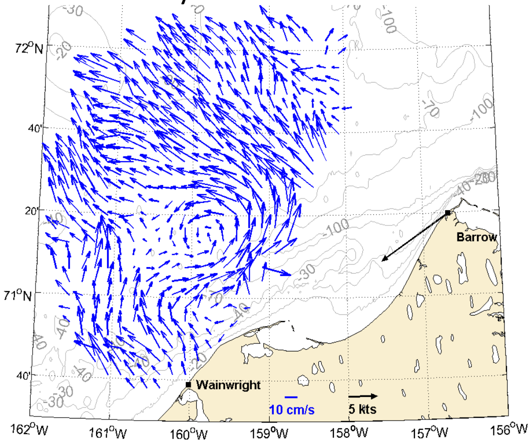
Key climate regulator on short and long time scales



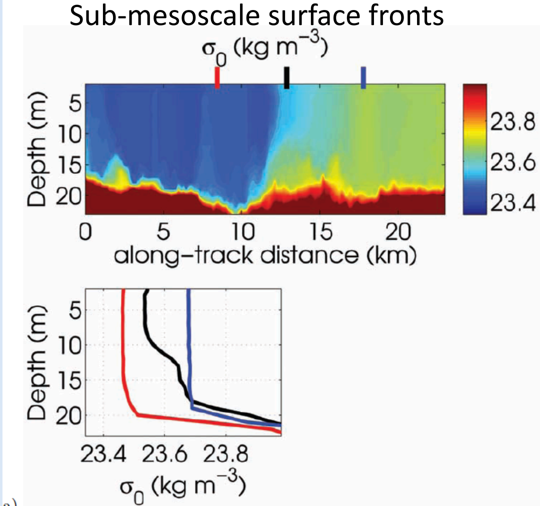
~1.0 Sv mean transport through Bering Strait

Exchange with the Arctic proper is not well known. Schematic advection pathways, but details are largely missing

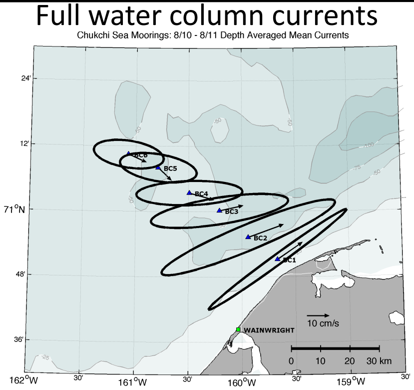
Stationary and transient eddies



Sub-mesoscale surface fronts



Full water column currents



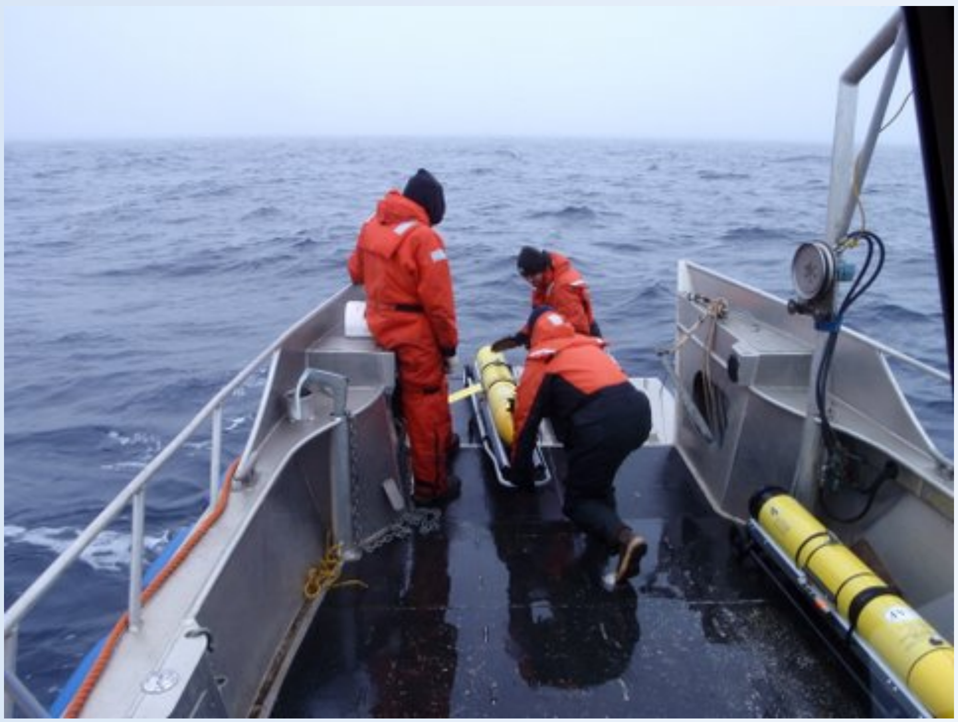
UAF group (Weingartner & Winsor PIs) have operated sub-surface moorings, HF radars, AUV gliders, and satellite-tracked drifters continuously since 2009.

Funding mainly from BOEM, Shell, ConocoPhillips, and DHS. IOOS-AOOS has funded one Webb Slocum glider and continues to support the Arctic glider program with primary lithium batteries and sensors.

2012 will include multiple mooring deployments, ~30 satellite-tracked drifters, 3 AUV gliders, 5 HF radar units in operation and a towed high-resolution CTD surveys. AOOS glider will perform repeat hydrographic sections over a 2 month period.

PI Winsor is pursuing funding for developing under-ice AUV mission capabilities (propelled and gliders)

Above: Webb Slocum G2 glider after a 2.5 month mission

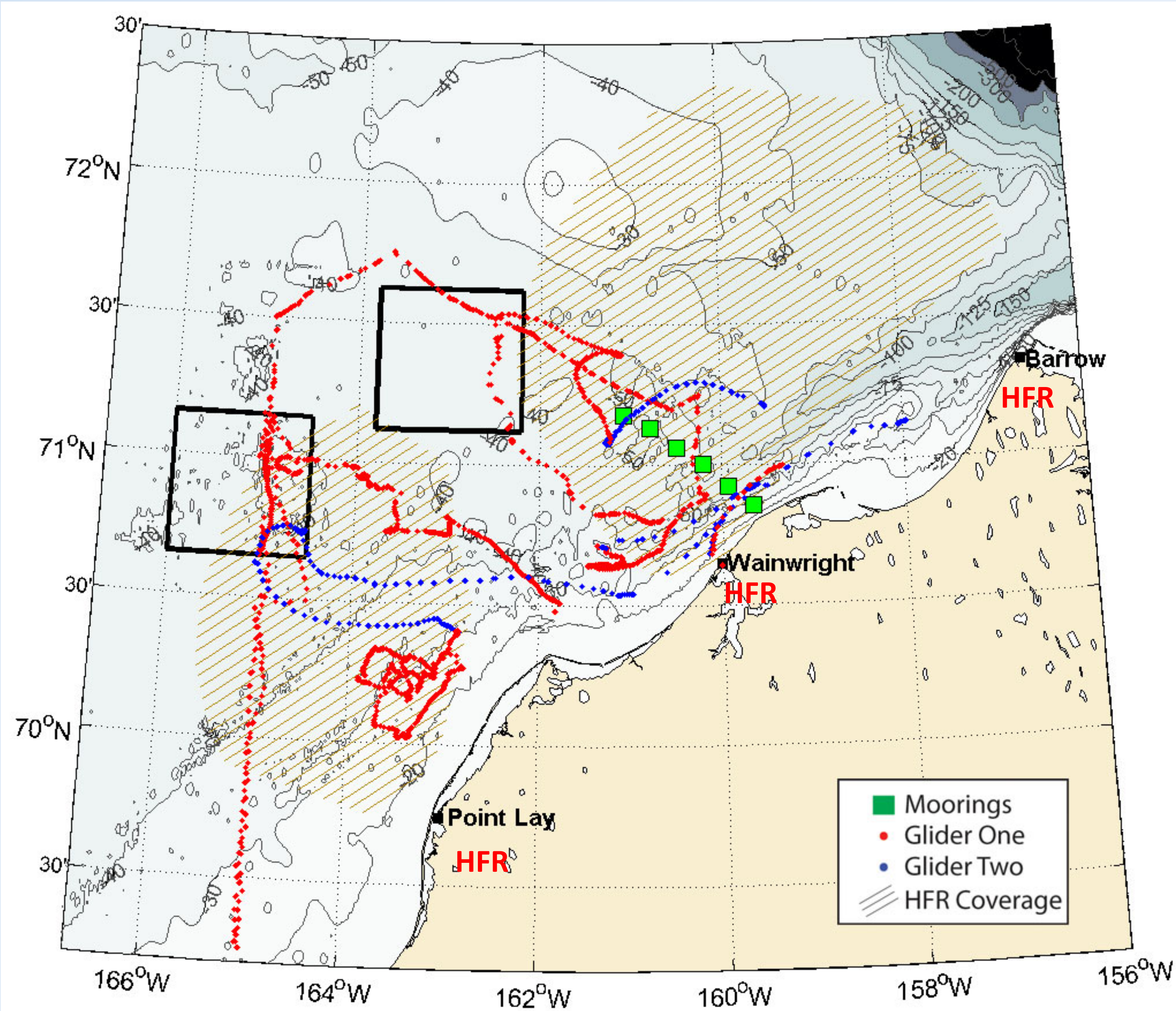

Above: Deploying gliders of the 32’ vessel “Tukpuk”

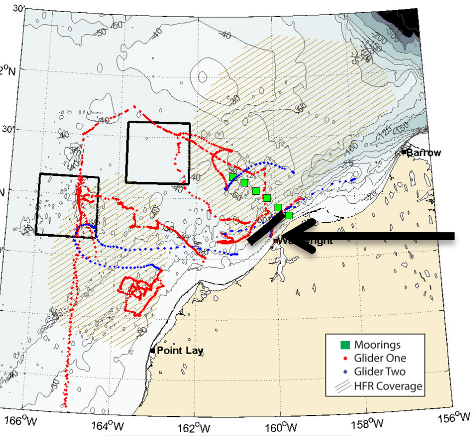
AUV operations in 2010 and 2011 using 3 Webb Slocum gliders performing > 6000 km of track length, collecting >20,000 CTD profiles. Also equipped with Wetlabs three-channel “Eco Pucks” for sampling hydrocarbon/CDOM and chlorophyll.

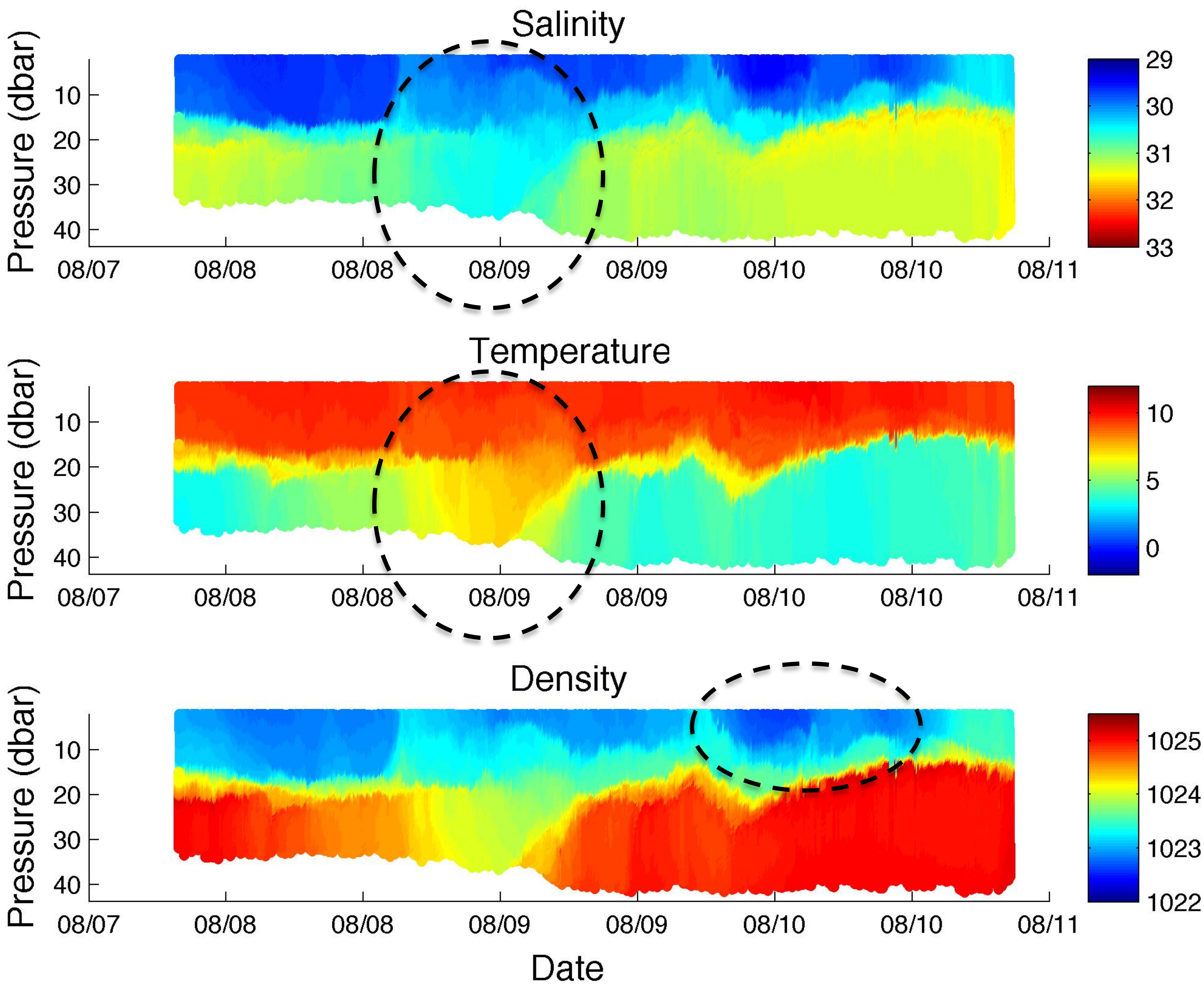
Longest single mission duration 2.5 months using lithium batteries. Small 30’ fast local landing vessel for deployments and recoveries.

2012: HF radar units are operational. AUV glider, drifter and mooring deployments will start in mid August.

2010-2011 Glider tracks, mooring array and HF radar coverage

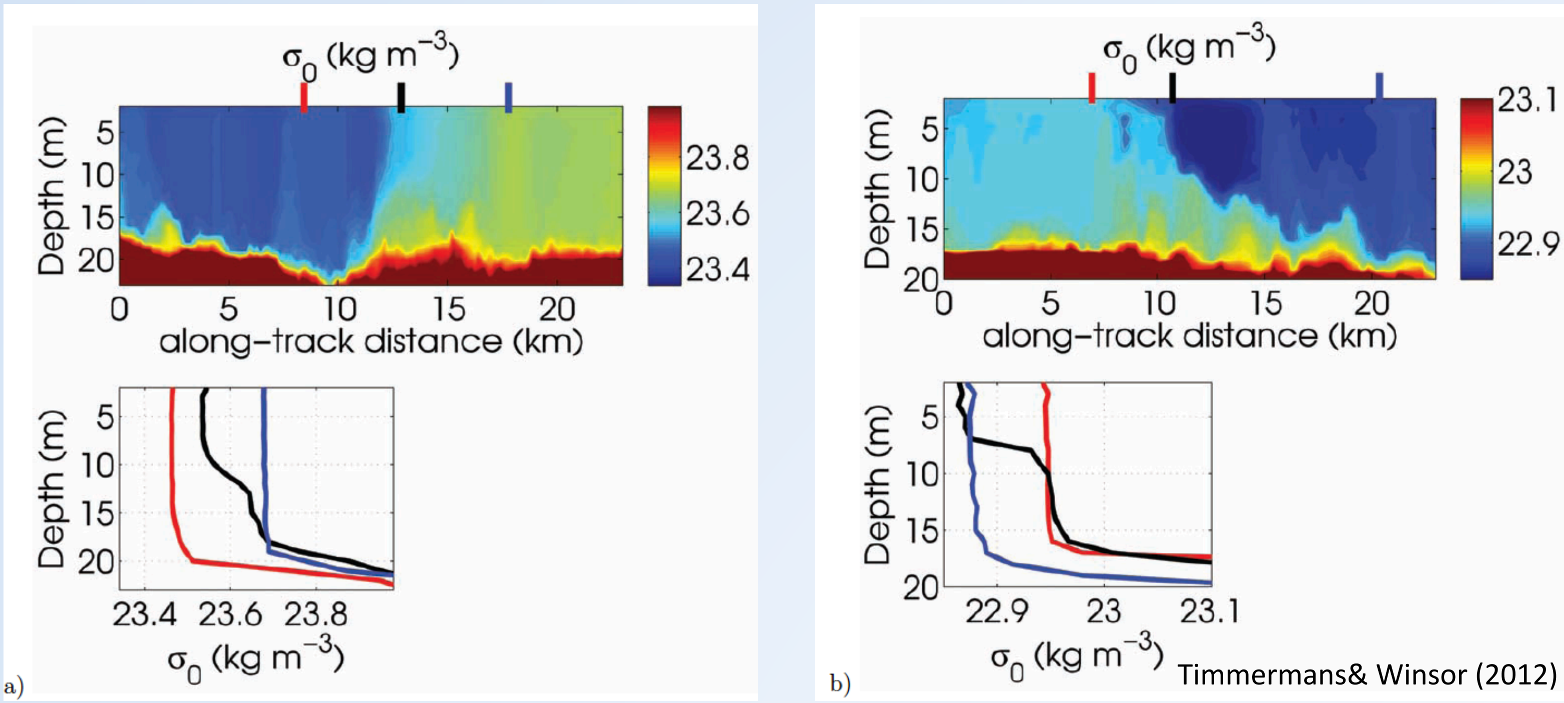






Hydrographic glider data from a three-day period, August, 2011 consisting of 513 vertical CTD profiles. Horizontal and vertical resolution ~ 200 m and 1 m, respectively

AUVs enable us to observe front and other important small scale features

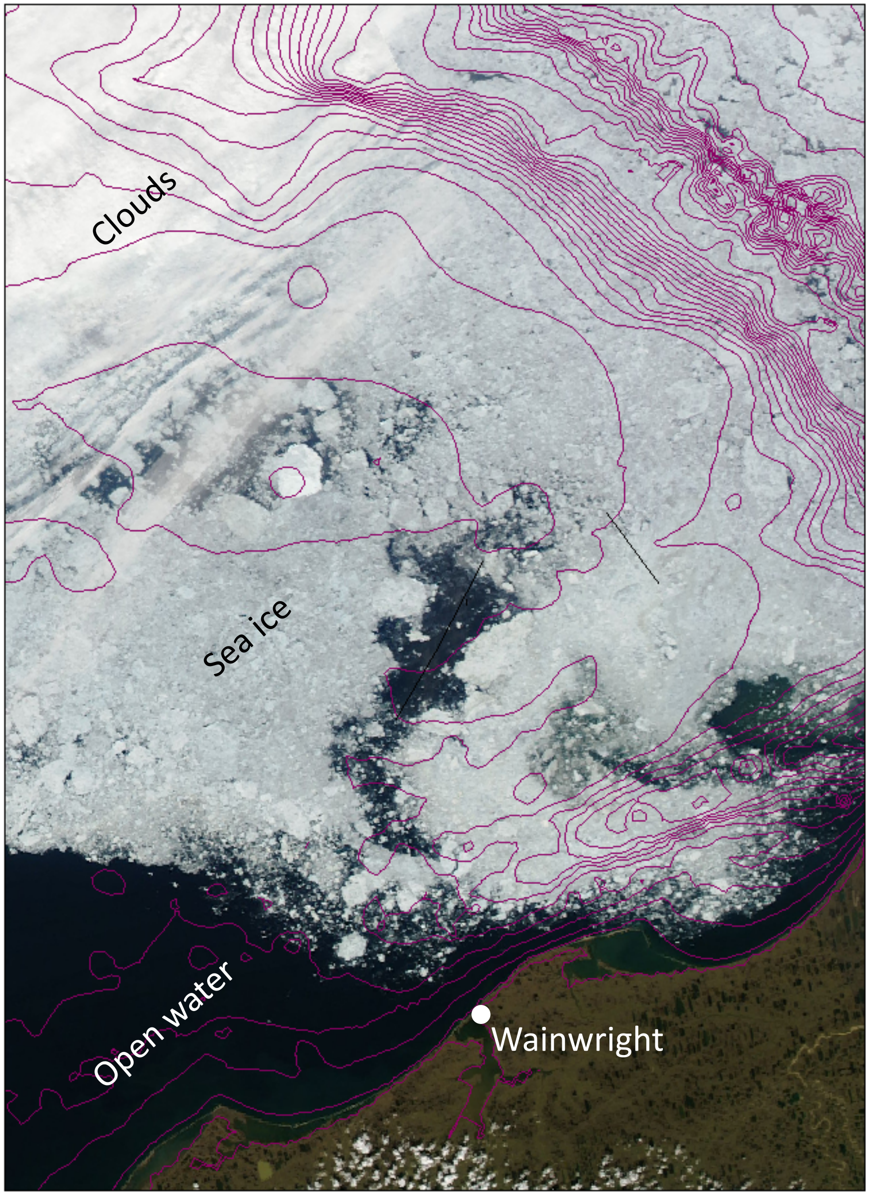


Timmermans& Winsor (2012)

The observed sub-mesoscale horizontal density fronts play a role in setting surface-layer properties by restratifying the mixed layer. This restratication opposes processes (e.g. buoyancy fluxes and winds) that vertically mix the surface ocean.

Glider observations enable us to observe these processes due to the high (~250 m) horizontal resolution. Important for biology (plankton, fish, seals, whales) and physical processes (mixing, advection, oil spill trajectories).

MODIS satellite image – July 11, 2012



Some challenges with Arctic AUV ops:
Presence of sea ice effectively limits the season for AUV operations

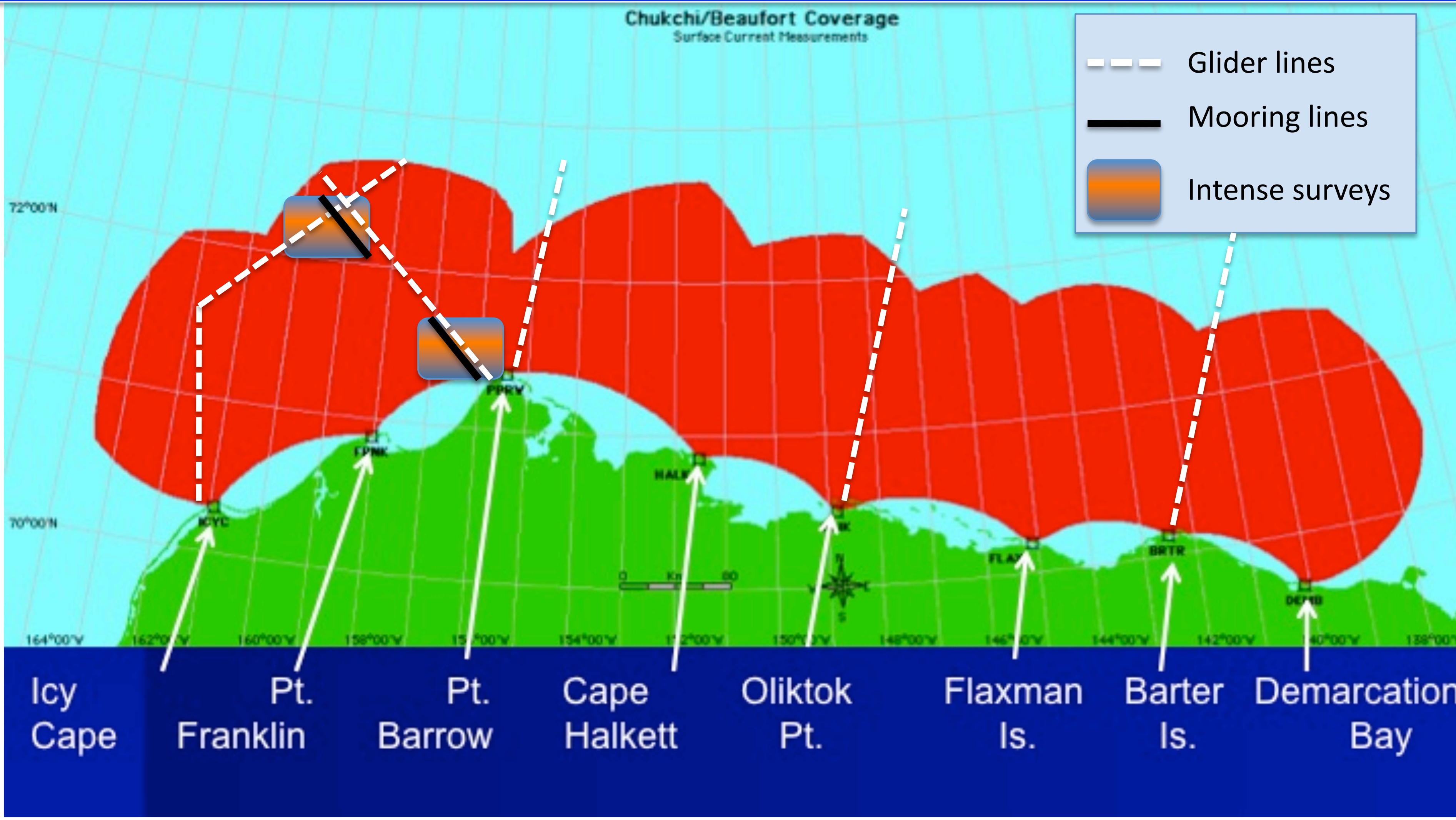
The effect of melted sea ice (buoyant waters) makes it challenging at times to operate current commercially available AUV gliders

Coastal jets (e.g. along Wainwright to Barrow – Barrow Canyon) can be too strong for maintaining control over AUV's flight path

Possible solutions:
Arctic specific coastal gliders with large buoyancy engine and fast glide speeds.

Develop under-ice operations – gliders and long-range propelled units with acoustic under-ice navigation for year round ops, including oil in and under sea ice detection and mapping

Future direction:
→Establish repeat glider transects onshelf and shelfbreak-to-deep Arctic
→Develop under-ice AUV capabilities – Coastal glider and MBARI *Tethys*
→Extend HF radar network to cover the Arctic Alaska coastline



Thank you!